

Claims

- [c1] What is claimed is:
- 1.A method of enhancing adhesion strength of a BSG film to a silicon nitride film, comprising:
- providing a semiconductor substrate having a silicon nitride film formed thereon;
- exposing the silicon nitride film to an oxygen-containing plasma; and
- depositing a BSG film on the silicon nitride film.
- [c2] 2.The method of claim 1 wherein the silicon nitride film is formed by using low-pressure chemical vapor deposition (LPCVD), plasma-enhanced CVD (PECVD), or high-density plasma CVD (HDPCVD).
- [c3] 3.The method of claim 1 wherein the silicon nitride film has a thickness of about 1000 to 2000 angstroms.
- [c4] 4.The method of claim 1 wherein the BSG film has a boron concentration of between 5% and 8% in weight.
- [c5] 5.The method of claim 4 wherein the BSG film has a boron concentration of about 5.53% in weight.
- [c6] 6.The method of claim 1 wherein the thickness of the BSG film is between 7,500 to 15,000 angstroms.
- [c7] 7.The method of claim 1 wherein the oxygen-containing plasma comprises mixed gas plasma of ozone and oxygen, oxygen plasma, NO plasma, N₂O plasma, or mixed gas plasma of ozone and inert gases.
- [c8] 8.The method of claim 1 wherein the oxygen-containing plasma consists of ozone and oxygen having an ozone/oxygen concentration of about 2% to 50% in weight, and wherein the oxygen-containing plasma is created under a high frequency radio frequency (HFRF) of about 1 to 9 W/cm².
- [c9] 9.The method of claim 1 wherein the silicon nitride film is exposed to the oxygen-containing plasma for about 5 seconds to 20 minutes.

[c10] 10.A method of manufacturing a deep trench, comprising:
providing a substrate;
forming an oxide layer on the substrate;
depositing a silicon nitride film over the oxide layer;
exposing the silicon nitride film to an oxygen-containing plasma for a predetermined time period;
depositing a BSG film over the silicon nitride film; and
dry-etching the substrate to form a deep trench by using the BSG film as a hard mask.

[c11] 11.The method of claim 10 wherein the silicon nitride film is formed by using low-pressure chemical vapor deposition (LPCVD), plasma-enhanced CVD (PECVD), or high-density plasma CVD (HDPCVD).

[c12] 12.The method of claim 10 wherein the silicon nitride film has a thickness of about 1000 to 2000 angstroms

13.The method of claim 10 wherein the BSG film has a boron concentration of between 5% and 8% in weight.

[c13] 14.The method of claim 10 wherein the BSG film has a boron concentration of about 5.53% in weight.

[c14] 15.The method of claim 10 wherein the thickness of the BSG film is between 7,500 to 15,000 angstroms.

[c15] 16.The method of claim 10 wherein the oxygen-containing plasma consists of ozone and oxygen having an ozone/oxygen concentration of about 2% to 50% in weight, and wherein the oxygen-containing plasma is created under a high frequency radio frequency (HFRF) of about 1 to 9 W/cm².

[c16] 17.The method of claim 10 wherein the oxygen-containing plasma comprises mixed gas plasma of ozone and oxygen, oxygen plasma, NO plasma, N₂ O plasma, or mixed gas plasma of ozone and inert gases.

[c17] 18.The method of claim 10 wherein the predetermined time period is between 5 seconds and 20 minutes.